MEMORANDUM

SUBJECT: Revision to CEB's Method for Screening-Level Assessments of Dermal Exposure

FROM: Greg Macek
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TO: CEB Staff and Contractors

THRU: Nhan Nguyen, Chief
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Attached is a revised table for screening-level assessments of dermal exposure to hands. This table is to be used in preparation of Initial Review Engineering Reports (IRERs) beginning June 1, 2000. There is also a table that presents guidance for qualitative assessments as discussed in the CEB Engineering Manual.

Attachment

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Revision to CEB's Dermal Method

Background

This revision to CEB's Dermal Exposure Assessment method incorporates the results of the 1996 peer reviewed research titled: Occupational Dermal Exposure Assessment - A Review of Methodologies and Field Data, as well as other recent dermal exposure studies.

Key findings and recommendations from the peer reviewed research report and other recent studies judged to be applicable to revising the CEB method are listed below.

1. Revise estimate of skin surface area of the hand (Recommendation in peer reviewed research report).
2. 'Q' values from 1984 Versar report (used in current CEB method) were updated in 1992 final report
3. Available data indicate a maximum dermal retention of 10 mg/cm2 for solids and 4 to 10 mg/cm2 for liquids (Conclusion in Peer Reviewed Research report)
4. 'Q' values for liquids derived from field monitoring studies (albeit pesticide handling) are available from PHED (Pesticide Handlers Exposure Database). (Data analyzed and presented in peer reviewed research report).
5. Field monitoring data for solids is now available for assessment of exposure in solids handling activities. (Current CEB method uses laboratory data for liquids in assessments of exposure in solids handling activities).
6. High quality data is available from PMN dermal monitoring study (non-pesticide field data for a liquid)
7. Use data from the other parts of the body with the current CEB method (Recommendation of the Peer Reviewed Research).
8. Guidance for qualitative assessments of dermal exposure is available to be incorporated into formal CEB Dermal Method. (Guidance in CEB Manual (CEB, 1991) used historically by CEB in PMN review program).

The revised table for screening-level assessments of dermal exposure to the hands is presented below in Table 1. Further information on the development of this table can be found in the CEB reference document, Options for Revising CEB's Method for Screening-Level Assessments of Dermal Exposure . Table 2 presents guidance for qualitative assessments.

Table 1: Factors for Screening-Level Assessments of Dermal Exposure to the Hands

Type of Contact[1]	Typical Examples	S[2] (cm^2)	Q[3] (mg/cm^2)	Resulting Dermal Contact (mg)
Routine, direct handling of solids - 2 hands	• Filling/dumping containers of powders, flakes, granules • Weighing powder/ scooping/mixing (i.e., dye weighing) • Handling wet or dried material in a filtration and drying process			up to 3100[4]
Routine contact with surfaces - 2 hands - solids	• Handling bags of solid materials (closed or empty)			up to 1100[4]
Routine immersion, 2 hands - liquids	• Handling wet surfaces • Spray painting	840	1.3 - 10.3	up to 8,700
Routine contact, 2 hands - liquids	• Maintenance • Manual cleaning of equipment • Filling drum with liquid	840	0.7 - 2.1	up to 1,800
Incidental contact, 2 hands - liquids	• Connecting transfer line	840	0.7 - 2.1	up to 1,800
Incidental contact, 1 hand - liquids	• Sampling • Ladling liquid/bench scale liquid transfer	420	0.7 - 2.1	up to 900

Notes:

1- The terms “routine” and “incidental” reflect typical CEB judgements on likelihood of contact for the example activities.
2 - Values of the skin surface area of the hands taken from: EPA Exposure Factors Handbook, 1997 and are the mean values for men
3 - Selected ranges of ‘Q’ Values for liquid handling activities taken from: EPA, 1992. A Laboratory Method to Determine the Retention of Liquids on the Surface of Hands, Exposure Evaluation Division, Office of Pollution Prevention and Toxic, USEPA, EPA 747-R-92-003, September, 1992.
4 - Values for dermal contact for solids handling activities were taken from: Lansink, 1996. Lansink, C.J.M., M.S.C. Breelen, J. Marquart, and J.J. van Hemmen: Skin Exposure to Calcium Carbonate in the Paint Industry. Preliminary Modeling of Skin Exposure Levels to Powders Based on Field Data (TNO Report V 96.064). Rijswijk, The Netherlands: TNO Nutrition and Food Research Institute, 1996.

Further details on derivation of this table can be found in: CEB, 2000. Options for Revising CEB’s Method for Screening-Level Estimates of Dermal Exposure. Final Report. 06/01/00.

Table 2: CEB Method for Screening-Level Assessments of Dermal Exposure - Qualitative Assessments[1]

Category	Dermal Assessment
- Corrosives (pH >12, pH <2)	Negligible
- Materials at temperatures >140 deg. F (60 deg. C)	Negligible
- Cast Solids (such as molded plastics)/PMN in matrices such as extruded pellets Ex. Chemical is an additive for plastics. It has been physically mixed and incorporated into a plastic pellet but not chemically reacted away.	Non-Quantifiable (Some surface contact may occur if manually transferred) Workers handling the plastic in the form of pellets could get surface contact with the chemical additive.
- "Dry" surface coatings (e.g., fiber spin finishes)	Non-Quantifiable (If manual handling is necessary and there is an indication that the material may abrade from the surface, quantify contact with fingers/palms as appropriate)
- Gases/Vapors	Non-Quantifiable (Some contact may occur in the absence of protective clothing)

Notes:

1 - Reference: (CEB, 1991). Chemical Engineering Branch Manual for the Preparation of Engineering Assessments, Washington, D.C.: Office of Toxic Substances, U.S. Environmental Protection Agency, 1991.

Other Guidance for Use

Screening-Level - The estimates of dermal contact presented in the table are intended for use in screening-level assessments of the type that CEB prepares for the new chemicals program.

More Refined Assessments - If there is a need for a more refined assessment, CEB assessors can review the studies in more detail to determine a more appropriate estimate for their situation. However, to ensure consistency, these more refined assessments should be reviewed and saved in a "Dermal" subdirectory on the K:\Group\CEB directory.

Exposure Descriptors - One of the objectives of the peer reviewed research report was to provide a literature search of monitoring data on dermal exposure. This included the open literature as well as data in the Pesticide Handlers Exposure Database (PHED) maintained by EPA's Office of Pesticides. This data was collected and analyzed and provides support that the upper-end values reported in the table are high-end estimates of potential dermal exposure.

Exposure to Other Parts of the Body

One of the recommendations of the peer reviewed research report was to use data on exposure to other parts of the body with the current CEB method. This resulted from review of the available data from the literature as well as PHED that showed exposure to other parts of the body. This was also shown in the previously mentioned dermal exposure study undertaken by a PMN submitter. Recommended factors for estimating dermal exposure to other parts of the body are presented in the Appendix. These values were taken from the estimated 90^{th} percentile deposition from the PHED database.

CEB believes that further development and input from risk assessors is needed before presenting an approach for estimating exposure to other parts of the body. This area has been identified as one of the areas for further development as part of CEB's effort to continuously improve its assessment methodologies. The available data show that hand exposure constitutes the majority of the total body exposure.

Part of Ongoing Effort

CEB regards the revised table as the logical next step in development of its dermal assessement methodology. As with all of its methodologies, improvement is an ongoing process. Areas that CEB plans to address in the future in addition to assessments of exposure to other parts of the body include revisiting the judgements of routine and incidental exposure and their application to the Exposure Based Policy and Peer review of the revised table.

REFERENCES

(CEB, 1991) Chemical Engineering Branch Manual for the Preparation of Engineering Assessments, Washington, D.C.: Office of Toxic Substances, U.S. Environmental Protection Agency, 1991.

(EPA, 1997) Exposure Factors Handbook - Volume 1: General Factors. USEPA, ORD, August 1997. EPA/600/P-95/002Fa

(EPA, 1992a) A Laboratory Method to Determine the Retention of Liquids on the Surface of Hands, Exposure Evaluation Division, Office of Pollution Prevention and Toxic, USEPA, EPA 747-R-92-003, September, 1992.

(Lansink, 1996) Lansink, C.J.M., M.S.C. Breelen, J. Marquart, and J.J. van Hemmen: Skin Exposure to Calcium Carbonate in the Paint Industry. Preliminary Modeling of Skin Exposure Levels to Powders Based on Field Data (TNO Report V 96.064). Rijswijk, The Netherlands: TNO Nutrition and Food Research Institute, 1996.

(SAIC, 1996) Science Applications International Corporation. Occupational Dermal Exposure Assessment - A Review of Methodologies and Field Data. Final Report. Prepared for the U.S. EPA, Office of Pollution Prevention and Toxic, Chemical Engineering Branch. September 30, 1996.

(Versar, 1984) Versar, Inc., Exposure Assessment for Retention of Chemical Liquids on Hands, Washington, D.C., Exposure Evaluation Division, U.S. Environmental Protection Agency, Contract No. 68-01-6271

APPENDIX

Table 8-1 from SAIC, 1996: Recommended Dermal Retention Rates as Input parameters for the CEB Dermal Exposure Estimating Method

Dermal Retention (ug/cm2)				
Body Section	**Mixing of Aqueous Suspension**	**Mixing of Solution**	**Mixing of Wettable Powder with Liquid**	**Dry Mixing of Granule**
Head/Face	15	15	10	20
Shoulder	10	10	110	50
Upper Arms	1	5	–	30
Chest	60	40	120	60
Back	10	10	100	10
Forearms	10	50	240	240
Thigh	110	30	90	160
Shin or Calf	–	30	30	–
Ankle	10	–	1	–